Technical Notes

Surveillance of HIV Infection (Not AIDS)

This report includes data from case reports from 53 areas (see Table 18 for list of areas) that had laws or regulations requiring confidential reporting by name for adults, adolescents, and children with confirmed HIV infection (not AIDS) in addition to the reporting of persons with AIDS as of December 31, 2007. After the removal of personal identifying information, data from these reports were submitted to CDC. The implementation of HIV reporting has differed from state to state. Before 1991, surveillance of HIV infection (not AIDS) was not standardized, and the reporting of HIV infection (not AIDS) was based primarily on passive surveillance. The information on many of the cases reported before 1991 is not complete. Since then, CDC has assisted states in conducting active surveillance of HIV infection (not AIDS) by the use of standardized report forms and software.

Data on HIV infection (not AIDS) should be interpreted with caution. HIV surveillance reports may not be representative of all persons infected with HIV because not all infected persons have been tested. Many HIV-reporting states offer anonymous HIV testing; the results of anonymous tests are not reported to the confidential name-based HIV registries of state and local health departments. Therefore, reports of confidential test results may not represent all persons who tested positive for HIV infection. Furthermore, many factors, including the extent to which testing is routinely offered to specific groups and the availability of, and access to, medical care and testing services, may influence testing patterns. These data provide a minimum estimate of the number of persons known to be HIV infected in states with confidential HIV reporting. As of December 31, 2007, 2 areas (Hawaii and Vermont) had implemented a code-based system for conducting case surveillance of HIV infection (not AIDS). Maryland had implemented confidential name-based HIV infection reporting but had not begun reporting cases to CDC. Data on cases of HIV infection (not AIDS) from these areas are not included in the HIV data tables.

For this report, we classified cases in adults, adolescents, and children aged 18 months and older by using the 2000 revised HIV surveillance case definition, which incorporates positive test results or reports of a detectable quantity of HIV nucleic acid or plasma HIV RNA [1]. For children younger than 18 months, the pediatric HIV reporting criteria reflect diagnostic advances that permit the diagnosis of HIV infection during the first months of life. By the use of HIV nucleic acid detection tests, HIV infection can be detected in nearly all infants aged 1 month and older. The timing of the HIV serologic and HIV nucleic acid detection tests specified in the definitive and presumptive criteria for HIV infection is based on the recommended practices for diagnosing infection in children younger than 18 months and on evaluations of the performance of these tests for children in this age group. Children younger than 18 months who were born to an HIV-infected mother were categorized as having been exposed perinatally to HIV infection if the child did not meet the criteria for HIV infection or the criteria for "not infected with HIV" [1, 2]. Children born before 1994 were considered HIV infected if they met the HIV case definition in the 1987 pediatric classification system for HIV infection [3].

Because states initiated reporting on different dates, the length of time that reporting has been in place influences the number of HIV infection cases reported. For example, data presented for a given year may include cases reported during only part of the year. Before implementing statewide HIV reporting, some states collected data on cases of HIV infection (not AIDS) in selected populations. Therefore, these states have reports that precede the initiation of statewide confidential reporting. A state with confidential HIV infection reporting also may report persons who tested positive in that state but who were residents of other states. Therefore, when HIV data are presented by state of residence, cases reported before a state initiated reporting may have been reported from a state that did have confidential HIV infection reporting.

Over time, HIV infection may progress to AIDS and be reported to surveillance. Persons with HIV infection (not AIDS) who are later reported as having

AIDS are deleted from the HIV infection (not AIDS) tables and added to the AIDS tables. Persons with HIV infection may be tested at any point on the clinical spectrum of disease; therefore, the time between diagnosis of HIV infection and diagnosis of AIDS differs. In addition, because surveillance practices differ, the reporting and updating of persons' clinical and vital status differ among states. The completeness of reporting of HIV infection (not AIDS) is estimated at more than 80% [4].

Surveillance of AIDS

All 50 states, the District of Columbia, and U.S. dependent areas report AIDS cases to CDC by using a uniform surveillance case definition and case report form. The original definition was modified in 1985 and 1987 [5, 6]. The case definition for adults and adolescents was modified again in 1993 [7; see also 8]. The revisions incorporated a broader range of AIDS-indicator diseases and conditions and used HIV diagnostic tests to improve the sensitivity and specificity of the definition. The laboratory and diagnostic criteria for the 1987 pediatric case definition [3] were updated in 1994 [9]. Effective January 1, 2000, the surveillance case definition for HIV infection was revised to incorporate new laboratory tests. The definition incorporates the reporting criteria for HIV infection and AIDS into a single case definition for adults and children [1].

For persons with laboratory-confirmed HIV infection, the 1987 revision incorporated encephalopathy, wasting syndrome, and other indicator diseases that are diagnosed presumptively (i.e., without confirmatory laboratory evidence of opportunistic infection). In addition to the 23 clinical conditions in the 1987 definition, the 1993 case definition for adults and adolescents includes HIV infection among persons with CD4+ T-lymphocyte counts of fewer than 200 cells/μL or a CD4+ percentage of less than 14 or a diagnosis of pulmonary tuberculosis, recurrent pneumonia, or invasive cervical cancer. For adults, adolescents, and children aged 18 months and older, the 2000 revised HIV surveillance case definition incorporates positive test results or reports of a detectable quantity of HIV nucleic acid or plasma HIV RNA.

The pediatric case definition incorporates the revised 1994 pediatric classification system for evidence of HIV infection. Cases in children who tested positive by Western blot or HIV detection tests before October 1994 were categorized according to the 1987 classification system. For children of any age (birth to 13 years) with an AIDS-defining condition that requires evidence of HIV infection, a single positive HIV virologic test result (i.e., HIV nucleic acid [DNA or RNA], HIV viral culture, HIV p24 antigen) is sufficient for a reportable AIDS diagnosis if the diagnosis is documented by a physician.

Although the completeness of reporting of AIDS cases to state and local health departments differs by geographic region and patient population, studies conducted by state and local health departments indicate that the reporting of AIDS cases in most areas of the United States is more than 85% complete (CDC, unpublished data, 2005) [4, 10–11]. In addition, multiple routes of exposure, opportunistic infections diagnosed after the initial AIDS case report was submitted to CDC, and vital status may not be determined or reported for all cases. However, for persons reported as having AIDS, the reporting of deaths is estimated to be more than 90% complete [12].

Since January 1, 1994, CDC has not accepted AIDS case reports that meet only the laboratory-based immunologic criteria of the 1993 expanded surveillance case definition [7] if information on sex or race/ethnicity is missing. A small number of case reports previously submitted to CDC without those variables have been returned to the health departments for follow-up and have been deleted from the totals.

Tabulation and Presentation of Data

The data in this report are provisional. This report includes information received by CDC through June 30, 2008. This report is organized in 5 sections. In Sections 1–3 (i.e., Tables 1–14 and Figure 1), data have been statistically adjusted for delays in the reporting of cases and deaths and for missing risk-factor information. For the assessment of trends in cases, deaths, or prevalence, it is preferable to use adjusted data, presented by year of diagnosis instead of year of report, to eliminate artifacts of reporting in the surveillance system. Section 4, which presents survival data, is discussed later in the Technical Notes. In Section 5 (Tables 16–25), HIV and AIDS data are tabulated by date of report to CDC.

Areas with Mature HIV Reporting System Included in Estimates of Cases of HIV Infection

The inclusion of areas with mature confidential name-based HIV reporting for tabulation and presentation of HIV/AIDS and HIV infection (not AIDS) data was based on the date that HIV infection reporting was implemented in the area and the ability to calculate 4 years of reporting delays in order to display trends reliably [13, 14]. This report includes 39 areas (34 states and 5 U.S. dependent areas) with laws or regulations requiring confidential name-based HIV infection reporting since at least 2003. The 39 areas comprise 34 states (Alabama, Alaska, Arizona, Arkansas, Colorado, Florida, Georgia, Idaho, Indiana, Iowa, Kansas, Louisiana, Michigan, Minnesota, Mississippi, Missouri, Nebraska, Nevada, New Jersey, New Mexico, New York, North Carolina, North Dakota, Ohio, Oklahoma, South Carolina, South Dakota, Tennessee, Texas, Utah, Virginia, West Virginia, Wisconsin, and Wyoming) and 5 U.S. dependent areas (American Samoa, Guam, the Northern Mariana Islands, Puerto Rico, and the U.S. Virgin Islands). For Tables 1 and 2, we used data from these 39 areas to estimate the numbers of cases of HIV/AIDS. We also used these data to estimate the numbers of persons living with HIV/AIDS (Tables 9 and 10) and to estimate the number of diagnoses of HIV infection (not AIDS) (Table 14).

Areas with HIV Reporting System as of December 31, 2007, Included in Reports of HIV Infection (Not AIDS)

Areas included in tabulations of reports of HIV infection (not AIDS) are based on the date of implementation of name-based HIV infection reporting as of December 31, 2007. For Tables 18, 20, 22, and 24, we used data from 53 areas (47 states, the District of Columbia, and 5 U.S. dependent areas) to describe reports of cases of HIV infection (not AIDS).

Age

The designation "adults and adolescents" refers to persons aged 13 years and older; the designation "children" refers to persons less than 13 years of age. For presentations of data on persons living with HIV/AIDS, HIV infection (not AIDS), or AIDS (Tables 9–14), the age-group assignment is based on the person's age as of December 31, 2007. For Table 8, which concerns deaths of persons with AIDS, age-group assignment is determined by the person's age at the time of death. For all other tables, the age designation (for example, "adults and adolescents") or the specific age-group assignment (for example, 20–24 years) is based on the person's age at the time of the first documented positive result of an HIV antibody test (for persons with a diagnosis of HIV infection) or the person's age at the time AIDS was diagnosed.

Race and Ethnicity

In the *Federal Register* for October 30, 1997 [15], the Office of Management and Budget (OMB) announced the Revisions to the Standards for the Classification of Federal Data on Race and Ethnicity. Implementation by January 1, 2003, was mandated. At a minimum, data on the following racial categories should be collected:

- American Indian or Alaska Native
- Asian
- black or African American
- Native Hawaiian or Other Pacific Islander
- white

Additionally, systems must be able to retain information when multiple racial categories are reported. In addition to data on race, data on 2 categories of ethnicity should be collected:

- Hispanic or Latino
- not Hispanic or Latino

This report is the first annual surveillance report in which the new racial categories have been used for presentation of HIV/AIDS and AIDS surveillance data. The Asian or Pacific Islander category displayed in previous HIV/AIDS surveillance reports has been split into 2 categories: (1) Asian and (2) Native Hawaiian or other Pacific Islander. The Asian category includes the cases in Asians/Pacific Islanders (referred to as legacy cases) that were reported before the implementation of the new racial categories in 2003 and a small percentage of cases in Asians/Pacific Islanders that were reported after 2003 but that were reported according to the old racial category (Asian/Pacific Islander). Persons who reported multiple racial categories or whose race was unknown are included in the total numbers in Tables 1, 2, 4–6, 8–10, 12, 13, 15, and 21–25. Also, the number of persons reported in each race category may include per-

sons whose ethnicity was not reported. In this report, the persons categorized as white or black/African American were not Hispanic or Latino.

Cases of HIV/AIDS and AIDS

In this report, the term *HIV/AIDS* is used to refer to 3 categories of diagnoses collectively: (1) a diagnosis of HIV infection (not AIDS), (2) a diagnosis of HIV infection with a later diagnosis of AIDS, and (3) concurrent diagnoses of HIV infection and AIDS. For analyses of HIV/AIDS data, we used data from 39 areas (i.e., 34 states and 5 U.S. dependent areas) that have had HIV infection reporting for a sufficient length of time (i.e., since at least 2003) to allow for stabilization of data collection and for adjustment of the data in order to monitor trends. Tables 1, 2, 9, and 10 summarize cases and prevalence of HIV/AIDS. For analysis of AIDS cases, we used data from the 50 states, the District of Columbia, and U.S. dependent areas.

HIV Incidence

In 1998, Janssen and colleagues described the serologic testing algorithm for recent HIV seroconversion (STARHS). This procedure made it possible to estimate HIV incidence by classifying HIV infections as recent or longstanding through the combined use of the standard enzyme immunoassay (EIA) and a biomarker test (currently, the BED [named for the 3 HIV subtypes that constitute the polypeptide] HIV-1 capture EIA) [16, 17]. HIV incidence surveillance programs integrated HIV incidence surveillance into their HIV surveillance systems by (1) ensuring that remnant HIV-positive diagnostic specimens were tested by using STARHS and (2) collecting data on the person's history of HIV testing and antiretroviral use [18]. This report presents population-based HIV incidence estimates obtained through CDC's HIV incidence surveillance.

A stratified extrapolation approach based on a sample survey method was used to determine the population-based HIV incidence estimate [19]. The estimated number of new HIV infections in 2006 in the 50 states and the District of Columbia was based on the total number of persons in 22 states whose HIV diagnosis had been made during 2006 and a sample of those persons, whose specimens had been tested by the BED assay and whose BED result classified their infection as recent. A sampling weight was assigned to each person in the sample; the weight was based on the probability that the person was tested for HIV within 1 year after infection and the probability that the BED result was "recent." All infections diagnosed as AIDS at the time of, or within 6 months after, a diagnosis of HIV infection were classified as long-term infections.

Because HIV incidence estimates require additional time for the receipt of STARHS results, estimates described in this report are for 2006. HIV incidence was estimated by using data on persons in 22 states who were 13 years or older, whose HIV infection had been diagnosed (with or without a concurrent AIDS diagnosis) during 2006, and whose case had been reported to CDC by the end of June 2007. The 22 states are Alabama, Arizona, Colorado, Connecticut, Florida, Georgia, Illinois, Indiana, Louisiana, Michigan, Mississippi, Missouri, New Jersey, New York, North Carolina, Oklahoma, Pennsylvania, South Carolina, Tennessee, Texas, Virginia, and Washington. The estimate of incidence in these 22 states was extrapolated to the 50 states and the District of Columbia by determining the ratio of HIV incidence to AIDS diagnosis in the 22 states that contributed data and applying that ratio to the AIDS diagnoses in states without HIV incidence surveillance. Because the HIV incidence estimates presented in Table 3 are for 2006, the race/ethnicity categories are the categories used in previous surveillance reports and thus are not consistent with the race/ethnicity categories used in other tables of this report.

Persons Living with HIV/AIDS, HIV Infection (Not AIDS), or AIDS

Tabulations of persons living with HIV/AIDS, HIV infection (not AIDS), or with AIDS (Tables 9–14) do not reflect actual counts of cases reported to the surveillance system. Rather, the estimates are based on numbers of reported cases, which have been adjusted for delays in the reporting of cases and deaths.

Deaths of Persons with AIDS

Tabulations of deaths of persons with AIDS (Table 8) do not reflect actual counts of deaths reported to the surveillance system. Rather, the estimates are based on numbers of reported deaths, which have been adjusted for delays in reporting.

Geographic Designations

The areas of residence included in the report are defined as follows:

Northeast: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont

Midwest: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin

South: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia

West: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming

U.S. dependent areas: American Samoa, Guam, the Northern Mariana Islands, Puerto Rico, and the U.S. Virgin Islands

Metropolitan Statistical Areas

In the *Federal Register* for December 27, 2000, the OMB published revised standards for defining metropolitan statistical areas (MSAs) for use in federal statistical activities [20]. These standards, which provided for the identification of MSAs in the United States and Puerto Rico, replaced the 1990 standards. The adoption of the new standards was effective as of December 27, 2000. On June 6, 2003, the OMB announced new MSA definitions based on the new standards and Census 2000 data [21]. Table 17 presents reported AIDS cases, by MSA, for areas with populations of more than 500,000. The MSAs listed in Table 17 are defined according to the OMB's most recent update (November 2007) of statistical areas [22].

Survival Analyses

For the survival analyses presented in Section 4 (Table 15 and Figures 2–4), we used the Kaplan-Meier method to estimate the probability of survival for persons with AIDS whose case data were reported by June 30, 2008. Table 15 was limited to AIDS cases diagnosed during 2002, and Figures 2–4 were limited to cases diagnosed during 1998–2005. Table 15 and the figures were limited to deaths through December 31, 2006; this was done to allow at least 18 months for a death to be reported by June 30, 2008, and to allow at least 1 year between AIDS diagnosis and death.

Transmission Categories

Transmission category is the term for the classification of cases that summarizes a person's possible HIV risk factors; the summary classification results from selecting, from the presumed hierarchical order of probability, the 1 risk factor most likely to have been responsible for transmission. For surveillance purposes, cases of HIV/AIDS, HIV infection (not AIDS), and AIDS are counted only once in the hierarchy of transmission categories. Persons with more than 1 reported risk factor for HIV infection are classified in the transmission category listed first in the hierarchy. The exception is men who report sexual contact with other men and injection drug use; this group makes up a separate transmission category.

Persons whose transmission category is classified as male-to-male sexual contact include men who report sexual contact with other men (i.e., homosexual contact) and men who report sexual contact with both men and women (i.e., bisexual contact). Persons whose transmission category is classified as high-risk heterosexual contact are persons who report specific heterosexual contact with a person known to have, or to be at high risk for, HIV infection (e.g., an injection drug user).

Adults and adolescents born in, or who had sex with someone born in, a country where heterosexual transmission was believed to be the predominant mode of HIV transmission (formerly classified as Pattern II countries by the World Health Organization) are no longer classified as having heterosexually acquired HIV infection unless they meet the criteria stated in the preceding paragraph. Similar to other cases in persons who were reported without information about a behavioral or a transfusion risk factor for HIV infection, these cases are classified (in the absence of other risk factor information that would classify them in another transmission category) as "no risk factor reported or identified" [23]. Cases in children whose mother was born in, or whose mother had sex with someone born in, a Pattern II country are now classified (in the absence of other risk factor information that would classify them in another transmission category) as "mother with documented HIV infection, a risk factor for HIV infection, or HIV infection without a specified risk factor."

Cases in persons with no reported exposure to HIV through any of the routes listed in the hierarchy of transmission categories are classified as "no risk factor reported or identified." No identified risk factor (NIR) cases include cases that have been followed up by local health department officials; cases in persons whose exposure history is missing because they died, declined to be interviewed, or were lost to follow-up; and cases in persons who were interviewed or for whom other follow-up information was available but for whom no mode of exposure was identified.

As of September 2000, the procedures for investigating cases reported without risk factor information changed from ascertaining a risk factor for all reported cases to estimating risk factor distributions from statistical models and population-based samples. States continue to investigate any report of an unusual exposure to HIV and report these cases to CDC. CDC will continue to tabulate the number of documented unusual exposures to HIV reported by the states.

Because a substantial proportion of cases of HIV infection and AIDS are reported to CDC without an identified risk factor, a statistical approach—multiple imputation—has been used in this report to assign a risk factor for these cases. Multiple imputation is a statistical approach in which each missing risk factor is replaced with a set of plausible values that represent the uncertainty about the true, but missing, value [24]. The plausible values are analyzed by using standard procedures, and the results from these analyses are then combined to produce the final results. Multiple imputation is preferable to the risk factor redistribution method used in previous reports because it preserves the relationship between risk factors and the other variables being analyzed. Our application of multiple imputation, unlike the risk factor redistribution method, does not include a variable indicating whether a risk factor was reclassified after initial report, because such a variable is not currently available [25]. In this report, multiple imputation has been used in tables and figures showing estimated values for cases in adults and adolescents, but not in tables and figures concerning cases in children (because the number of cases in children is small, missing risk factors were not imputed for these cases).

Reporting Delays

Reporting delays (time between diagnosis of HIV infection or AIDS and report to CDC) may differ among exposure, geographic, racial/ethnic, age, sex, and vital status categories; for some AIDS cases, delays have been as long as several years. Adjustments of the estimated data on HIV infection (not AIDS) and on AIDS to account for reporting delays are calculated by a maximum likelihood statistical procedure. This procedure takes into account the differences in reporting delays in exposure, geographic, racial/ethnic, age, sex, and vital status categories, and is based on the assumption that reporting delays in these categories have not changed over time [13, 14, 26].

Rates

Rates per 100,000 population were calculated for the numbers of cases of HIV/AIDS and AIDS (Tables 6a, 6b, 16, and 17) in 2007, as well as for persons living with HIV infection (not AIDS) or AIDS (Table 11) at the end of 2007. The population denominators used to compute these rates for the 50 states and the District of Columbia were based on official postcensus estimates for 2007 from the U.S. Census Bureau [27] and bridged-race estimates for 2007 obtained from the National Center for Health Statistics [28]. The bridged estimates are based on the Census 2000 counts and produced under a collaborative agreement with the U.S Census Bureau. These estimates result from bridging the 31 race categories used in Census 2000, as specified in the OMB's 1997 standards for the classification of data on race and ethnicity [15], to the 4 race categories specified in the 1977 standards. The population denominators for U.S. dependent areas were based on official postcensus estimates and Census 2000 counts from the U.S. Census Bureau's International Database. Each rate is calculated by dividing the number of cases reported during the 12 months in 2007 (or the number of persons living with HIV infection or with AIDS at the end of 2007) by the 2007 population, multiplied by 100,000. The denominators used for calculating age-, sex-, and race/ethnicity-specific rates are computed by applying the age, sex, and race/ethnicity proportions from the bridged-race population estimates for 2000 to the 2007 postcensus estimates of the total population for each state. When bridged-race population denominators for the U.S. dependent areas were not available, proportions from the U.S. Census Bureau's International Database for 2000 were used to estimate the age- and sex-specific subpopulations [29].

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